this axis; consequently in the line of the proper intermediate angle there is no dilatation or contraction whatever from heat. Endeavours will therefore be made thus to obtain an invariable standard measure of length, by comparison with which the rate of dilatation of measures variable with heat may be determined.

There are other subjects of the investigations of the committee which might be noticed, but we have probably stated enough to enable some idea to be formed of the magnitude of the work undertaken by the International Metric Commission, and of the value and importance of the anticipated results of their labours; as well as the advantages expected to be obtained from the proposed establishment of the permanent International Metric Institution.

H. W. CHISHOLM

DE MORGAN'S BUDGET OF PARADOXES

A Budget of Paradoxes. By A. De Morgan. (Longmans, 1872.)

THIS work is absolutely unique. Nothing in the slightest degree approaching it in its wonderful combinations has ever, to our knowledge, been produced. True and false science, theological, logical, metaphysical, physical, mathematical, &c., are interwoven in its pages in the most fantastic manner: and the author himself mingles with his puppets, showing off their peculiarities, posing them, helping them when diffident, restraining them when noisy, and even occasionally presenting himself as one of their number. All is done in the most perfect good-humour, so that the only incongruities we are sensible of are the sometimes savage remarks which several of his pet bears make about their dancing-master.

De Morgan was a man of extraordinary information. We use the word advisedly as including all that is meant by the several terms knowledge, science, erudition, &c. Everywhere he was thoroughly at home. An old edition and its value-giving peculiarities or defects, a complex mathematical formula with its proof and its congeners, a debated point in theology or logic, a quotation from some almost-unheard-of author, all came naturally to him, and from him. With a lively and ready wit, a singularly happy style, and admirable temper, he was exactly fitted to write a work like this. And every page of it shows that he thoroughly enjoyed his task. Witness, for instance, the following extract:—

> "I will not, from henceforward, talk to any squarer of the circle, trisector of the angle, duplicator of the cube, constructor of perpetual motion, subverter of gravitation, stagnator of the earth, builder of the universe, &c. I will receive any writings or books which require no answer, and read them when I please: I will certainly preserve them—this list may be enlarged at some future time. There are three subjects which I have hardly anything upon: astrology, mechanism, and the infallible way of winning at play. I have never cared to preserve astrology. The mechanists make models, and not books. The infallible winners—though I have seen a few—think their secret too valuable, and prefer *mutare quadrata rotundis*—to turn dice into coin—at the gaming-house: verily they have their reward."

He was not, let it be at once said, a great original mathematician—not, that is, of the order of men like Boole or Rowan Hamilton—but extraordinarily great mathematicians like these are very rare, and there were not in Britain a dozen who were his superiors. We are told in the Preface to this work that it was his intention to have composed a companion volume on "the contradictions and inconsistencies of orthodox learning." What a loss we have here sustained—how narrow an escape several of our most popularly idolised men of science, &c., have made—must be known to many, perhaps even dimly suspected (at least we hope so) by those who would assuredly have been the earliest and most prominent sufferers.

A great part of the volume consists of reprints from a series of almost weekly papers in the *Athenæum*; but much new matter has been added, and several modifications and corrections have been made. The task of editing has been undertaken by the author's widow, and appears to have been exceedingly well done throughout. The volume is not one which can be read through at a sitting—nor even at three or four: the multiplicity of subjects renders it bewildering if more than a dozen or two of pages be read at a time—but we do not envy the man who cannot, at a spare moment, find both pleasure and profit in the perusal of a moderate portion of it, taken *ad aperturam.*

De Morgan was a very dangerous antagonist. Ever ready, almost always thoroughly well informed, gifted with admirable powers of sarcasm which varied their method according to the temperament of his adversary, he was ready for all comers, gaily tilted against many so-called celebrities; and—upset them. It is unfortunate that the issue of his grand contest with Sir William Hamilton (the great Scottish Oxford Philosopher) is but in part indicated in this volume—it is softened down, in fact, till one can hardly recognise the features of the extraordinary *Athenæum* correspondence of 1847. There the ungovernable rage of the philosopher contrasts most strongly with the calm sarcasm of the mathematician, who was at every point his master, and who "played" him with the dexterity and the tenderness of old Isaak himself! But it is characteristic of De Morgan that, though he was grievously insulted throughout the greater part of this discussion, no trace of annoyance seems to have remained with him after the death of his antagonist; for none would gather from the "Budget" more than the faintest inkling of the amount of provocation he received.

Yet De Morgan had his weak points, and in an unguarded moment he made a first, and last, attack—one of the few assaults in which he was unsuccessful—on Faraday. At least he gets the credit of having reviewed a lecture of Faraday's in the *Athenæum* of 1857, and of having for once wholly missed the main point at issue.

To return to the "Budget." The tenderness displayed for trisectors, duplicators of the cube, circle squarers, perpetual motionists, *et hoc genus omne*—from J. Reddie through J. Symons, to J. Smith—is most touching. The real human interest evidently taken in the careers of those hopelessly ignorant writers, does credit to De Morgan's heart. He does not hang up his Paradoxer on high as a warning, nor does he dissect him for purposes of psychological study; he carefully spreads him out, under sufficient but not extravagant pressure, on the white page of his herbarium, and fondly preserves him as a specimen

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for his future lectures. Thus the specimens may be said to *live* in his pages, with all their bright motley of colour and their extraordinary odours—only *flattened* a little by the supreme necessities of the case.

Mingled with the paradoxes, and generally more or less directly suggested by them, we have many valuable pieces of information—as, for instance, about the calendar (pp. 219, &c.), the names of the "beast" (p. 403), the "Macclesfield Letters" (p. 448), &c.—and we have anecdotes, verses more or less confessedly doggrel, and paradoxes full-blown, from the author's own pen.

One extract must suffice, though there are hundreds equally good, for which we must refer the reader to this most thoroughly enjoyable book itself. Our choice is determined by the present aspect of the education question: and conveys a much-needed lesson to all who are capable of comprehending.

"It was somewhat more than twenty years after I had thus heard a Cambridge tutor show sense of the true place of Horner's method, that a pupil of mine who had passed on to Cambridge was desired by his College tutor to solve a certain cubic equation—one of an integer root of two figures. In a minute the work and answer were presented by Horner's method. 'How!' said the tutor, 'this can't be, you know.' 'There is the answer, sir,' said my pupil, greatly amused, for my pupils learnt not only Horner's method, but the estimation it held at Cambridge. 'Yes,' said the tutor, 'there is the answer, certainly; but it *stands to reason* that a cubic equation cannot be solved in this space.' He then sat down, went through a process about ten times as long, and then said with triumph, 'There! that is the way to solve a cubic equation!' I think the tutor in this case was never matched, except by the country organist. A master of the instrument went into the organ-loft during service, and asked the organist to let him *play the congregation out*; consent was given. The stranger, when the time came, began a voluntary, which made the people open their ears, and wonder who had got into the loft; they kept their places to enjoy the treat. When the organist saw this, he pushed the interloper off the stool, with 'You'll never play 'em out this side Christmas.' He then began his own drone, and the congregation began to move quietly away. 'There!' said he, 'that's the way to play 'em out!'"

BURMEISTER'S ANNALS OF THE PUBLIC MUSEUM OF BUENOS AYRES

Anales del Museo Publico de Buenos Ayres, para dar a conocer los objetos de Historia Natural nuevos o poco conocidos conservados en este establecimento. Por German Burmeister, M.D. Vol. ii., parts 1—4. (Buenos Ayres and London: Taylor and Francis.)

In a previous number of NATURE (vol. iii. p. 282), Prof. Flower has given our readers an account of the first volume of this most meritorious work, and of the objects of its distinguished author in undertaking it. Since Prof. Flowers's article was published, four parts of the second volume of the "Anales" have been issued, containing a series of articles and illustrations of quite as great zoological interest as those in the first volume. The wonders of the extinct Mammalian Fauna of the Argentine Republic are well known, and in the present volume Prof. Burmeister devotes himself to their exposition. In the first part he commences a complete monograph of the Glyptodonts, or extinct gigantic Armadillos, represented by specimens in the museum under his charges and carries it on to the end of Part IV. In the first volume of the "Annals" Prof. Burmeister, in the course of a general article on the fossil mammals of the diluvium of Buenos Ayres, had given a preliminary exposition of his views as to the arrangement of these wonderful animals. He now enters at length upon the description of the species known to him, and gives a series of splendid lithographs to illustrate their remains. Not only are the bones of the Glyptodonts so perfectly preserved as to enable many of the skeletons to be completely restored, but great portions of the extraordinary suits of armour with which they were clad above and below have likewise been discovered, so that their external appearance can likewise be portrayed. Those who interest themselves in palæontology will do well to secure copies of these beautiful illustrations, a few of which are on sale at Messrs. Taylor and Francis, of Red Lion Court, at 10*s.* a number.

We should add that, attached to each number of the "Anales" is a "Boletin del Museo Publico de Buenos Ayres," in which is given an account of the additions made to the establishment during the year. An important acquisition in 1871 was the series of remains of the *Machrauchenia patachonica*, an extinct animal allied to the horses and tapirs, formerly belonging to a naturalist named Bravard, who was killed in the earthquake of Mendoza. These specimens formed the basis of Prof. Burmeister's complete restoration of this animal, published in the first volume of the "Anales."

OUR BOOK SHELF

Notes on the Post-pliocene Geology of Canada, &c. By J. W. Dawson, LL.D., F.R.S., F.G.S. (Montreal: Mitchell and Wilson, 1872.)

THESE "Notes," which are reprinted from the *Canadian Naturalist*, cannot fail to interest European glacialists. Especially valuable for purposes of comparison are the detailed notes on the fossils obtained from the glacial beds. The lists include in all about 205 species, distributed as follows:—Radiata, 24; Mollusca, 140; Articulata, 26; Vertebrata, 5. All these, with three or four exceptions, may be affirmed, says the author, to be living northern or southern species. Moreover, the fauna of the older part of the Canadian glacial deposits is more Arctic in character than that of the modern part. It would thus appear that since the accumulation of the boulder-clay a gradual amelioration of climate has taken place; but the change from Arctic conditions has evidently been less decided on the west than on the east side of the Atlantic. Dr. Dawson's conclusions regarding what we may term the physics of the glacial epoch will probably meet with less acceptance than his palæontological results. He considers the Erie-clay described by Whittlesey, Newberry, and others to be of marine, and not of fresh-water origin, as these authors believe. But his reasons for this opinion can hardly be considered satisfactory. When an extensive deposit of fine clay, after having been examined over a wide area, is found not only to be totally destitute of marine organisms, but to contain quantities of drift-wood, and to have associated with it beds of peat and an old soil containing tree roots, the probabilities are that the clay-beds are of fresh-water origin. Besides, if we are not mistaken, fresh-water shells have been got in the Erie clay. That much-vexed question, the origin of boulder-clay comes in for some discussion in these "Notes," the author inclining to think the deposit is marine. It is somewhat significant, however, that the boulder-clay is only

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